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ABSTRACT

This paper explains recommended procedures for establishing a computer based, multimedia, computer managed system emphasizing self-paced, individualized instruction as an approach to learner controlled education. The basic components or modules of such a system are briefly described, including student information, instructional analysis, learning activity, and system evaluation. The necessity for a thorough understanding of learning theory and how it ties into classroom operation and material preparation is stressed in a review of applicable learning theories. Computer based education systems are described as the ideal delivery system for implementing a truly individualized system, and the importance of educational analysis in the identification and selection of instructional content and organization of the content into an instructional form is discussed. Also described is an individualized study guide, which contains specific sections on objectives, rationale, behavioral tasks, student assessment, self-tests, student evaluation by the teacher, recommended media, additional assignments, and packet evaluation. A step-by-step general procedure for developing or revising instructional materials for individualized learning is presented. Thirteen references are listed. (MBR)

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Operationalizing a Learner-Controlled Education System

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Abstract

This paper explains the procedures recommended for establishing Learner-Controlled Education for any subject area. The LCES system is best described as a computer-based, multi-media, computer-managed instructional approach which emphasises self-paced individualized learning. The theoretical construct of the model was explained in Vol. 11, (1), 1982-83 issue of The Journal of Educational Technology Systems (Jelden, Brown, 1982).

Introduction

LCES basically consists of four major components. They are the Student Information Module, the Instructional Analysis Module, the Learning Activity Module, and the System Evaluation Module. Each of these major components came into existance as a result of practical classroom application in an electronics lab and were generated out of need. These system components are depicted in Figure 1 and may be summarized as follows (Jelden and Brown, 1982);

Insert Figure 1 about here

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The Student Information Module (SIM) provides for an analysis of student strengths, weaknesses, experience, and goals. To truly individualize education this information is essential. The Instructional Analysis Module (IAM) was generated to identify the specific content of the program and to order it for instructional purposes. A psychological-logical order was chosen as experience in classroom use allowed criterion objectives to be set for each teaching unit. The Learning Activity Module (LAM) identified the support media, anotates the characteristics of the media, and provides a suggested learning sequence for each student. From the SIM research which has related success in the program to individual aptitude and personality variables a rough predictability profile for each student can be constructed. This diagnostic information fits the student to the characteristics of the media and sets out the most effective learning experience. All of the learning options are listed by the computer as part of the Computer Managed Instruction (CMI) program. Finally, the System Evaluation Module (SEM) contains the multivariate techniques for assessing the degree to which LCES optimizes learning. Such evaluations are conducted continually and provide the basis of the continuous modification and further development of the system's components and the interdependencies which exist among them.

The remainder of this paper is devoted to the detailed description of how an existing traditional classroom operation can be modified into a learner-controlled environment.

Where to Start

Much has been written on the "theories of learning" and "the philosophies of teaching." In every classroom or learning environment an interaction takes

place between the teacher and the student. The basis for the teacher's action in the classroom centers around the teachers basic beliefs about how learning takes place. That teacher's philosophy of education guides all decisions and judgments about learning that are made in that classroom.

Traditionally, teachers have been "trained" to lecture and present information to students in a rather strict, controlled environment where the students, in many cases were the passive recipients of information. The classroom environment, in many instances, was dominated by the teacher and became an extension of the teacher's ego. Teacher descipline was evaluated by the absence of noise and the deportment of students sitting in a row, raising their hands to vie for the teacher's attention as "discussion" was taking place. Students who didn't fit into that learning environment were chastised to conform or failed.

One of the most important requirements of a good teacher is their point of view toward students. The attitude, feelings and values that teachers have about the students they work with, their beliefs on how students learn etc., direct the classroom learning environment.

Each of us is unique. We see things differently. We have different statures, different general appearances, different preferences as well as many less obvious emotional differences. No matter what we as teachers are like, we must know what we are, how we feel and think and be willing to accept that judgment. Knowing these characteristics we should then utilize our strengths in helping students learn.

Educational methodology, is directed by what we as teachers can accept, tolerate, utilize, and employ to improve learning. A teacher who is a domineering individual is not likely to adapt well to a passive role in a

discovery model classroom. Likewise, one who asks more questions than they answer is not likely to be an efficient presenter of information through the lecture method. The individual and unique personalities of teachers will, without exception, govern the basic structure of their classroom environment. Any educational system or model must be flexible enough to tolerate exception and modification within the philosophical framework of the teacher. What must exist, however, is a written philosophical position or point of view with which the teacher is willing to live. It must address personality characteristics, aptitudes and basic moral questions, identifying strengths and weaknesses. Good teachers are willing to extend themselves beyond existing practice and adopt a feeling of "we are anxious to do better."

Educational Methodology

Directly related to ones Educational Philosophy is their belief on how students learn. Research in modern educational psychology identifies several prominent structures relating to teaching and learning (Barsch, 1980; London, 1958). All of these approaches can be utilized and accepted as contributing toward a computer based education system and applicable toward in individualized learning system. In fact, practice has made it virtually impossible to stipulate that students employ only one system. The accepted belief is that all contribute in some way to ones acquisition of skill, knowledge and attitude. Realize also, that these descriptions are simplified explanations of very complex and abstract processes.

The oldest theory of learning referenced is "animism." It is based on superstition, mastery of ritual and ceremonies. Educationally, it has no place in modern methodology but vestiges of it still exist in our everyday

society. Witness, for example, the notions of knocking on wood, the rabbit's foot and the lucky horseshoe.

A second learning theory expressed "faculty psychology" treats the mind as a mental substance. Mankind in his early beginnings through careful observation and reflective thinking came to distinguish between mind and matter. Educationally, the training and exercising of the mind was approached much as muscles are developed through exercise. Thus Latin, Greek and mental mathematics were held in high esteem as they became the most difficult to master. Today, educational drill and practice which relies primarily on memorization without reason is an application of faculty psychology. This theory assumed maximum transfer of training.

A third concept of the mind was one of a series of mental states. The development of the "apperceptive mass," sometimes known as "Herbartion psychology." Education, according to this theory, was a matter of building up an appropriate background or apperceptive mass with which to combine present experiences. Because of this theory, educators began to broaden their subjects to include technical information and the respect for labor, orderly methods of work, neatness, accuracy, patience and self-reliance. Transfer of training was assumed just to the extent that past experiences were helpful in solving the present situation at hand. (The greater part of courage is having done the thing before.)

The most recent conception of the mind is that of mind as a function. It is divided into two parts. One is "physiological psychology" (mechanistic S-R) and "organismic psychology" (Gestalt).

S-R bond psychology attempts to explain all behavior in terms of stimulus and response. It assumes that all behavior can be reduced to mechanical

terms. Education, according to this theory, is a matter of conditioning reflexes and forming new stimulus-response connections so as to fix them in the form of desirable habits and patterns of conduct. This theory denies that existence of any form of transfer of training, except in identical elements, which in reality is not transfer at all. Every new experience is a new stimulus-response connection which must be specific and related directly to its use.

Organismic or Gestalt psychology have moved to the forefront in recent years. It is the basis for the so-called "progressive education" movement. Like behaviorism, it regards mind as a function, but explains mental processes differently. It holds that mind and body operate as a unit or as a whole, and that thinking is a process of reconstructing experience through which new meanings, insights and understandings are acquired. This theory accepts transfer of training as a matter of necessity and places major emphasis on intelligent reasoning and purposeful behavior. The ability to understand general concepts and draw conclusions is of supreme importance.[1] (London, 1958).

New theories may be developed in the future and old or present ones discarded, but in the final analysis, if skills and knowledges developed in the classroom are to function in the lives of people, then these skills and knowledges must somehow transfer outside the school. If teachers are to keep their instructional practices up-to-date, they must keep themselves informed in psychological theory and follow the ones to which they subscribe. In their practical classroom experience, too many teachers make decisions and set classroom procedures without actually knowing why from a psychological point of view.

The Delivery System

Computer based education now provides a method of utilizing information on learning theory, on course content and student characteristics which can be used to implement a truely individualized learning system. Both micro and mainframe systems employ student diagnostics and content presentations not possible a few years ago. (Ross, 1984; Tennyson 1979, 1980; Tennyson, et al. 1984).

Current research is being conducted on using the computer to assess the characteristics and learning styles of students. Existing inventories are available which can be administered to students by the computer and utilized in program presentation. (Barsch, 1980; Renzulli, 1978). Preliminary research using the diagnositics of the computer indicates that an important step in collecting student data is the personal interview. Information on student goals, motivation and interest are best identified this way (Jelden, 1971).

Several existing computer based education systems on the market are capable of managing the learning experiences of students. PHOENIX, distributed by Goal Systems, Inc. of Columbus, Ohio, was the system chosen for the LCE program. It contains two major elements CMI and CAI, which are interactive components allowing much flexibility in student management as well as tutorial support. The ease of use and the friendliness of the system to both teacher/authors and students is very good. It is a menu driven system which does not require a knowledge of programming language to operate. This characteristic reduces the anxiety of the user and provides a feeling of support for both the teacher and the student. Time does not allow for a detailed explanation of PHOENIX at this point. In general, the system provides both testing/management and tutorial instruction for courses, units and enrolled classes of students.

Content Identification

A major feature of the Learner-Controlled Education System is the sequence of identifying instructional content. Traditionally, teachers have had three choices for content selection. Teach everything, teach nothing, or select those things which contribute toward the objectives established for the program. This selective approach is called the scientific approach and implies a rigid methodology in its use. The technique of analysis is rather easy to learn and can be applied to virtually any subject discipline.

The basic part of the analytic approach is the identification of principles or concepts relevant to the subject. These generalizations are used as a basis for instruction. They are relatively stable and are less likely to change quickly as time passes. The subdivision of these major elements into instructional units is basic to quality and efficient teaching.

To help with the identification of principles and concepts, the following criteria are helpful. A principle:

(1) is it a fundamental process or mode of behavior?

(2) is it true without any exception?

(3) is it capable of demonstration or illustration?

(4) it should not be a part of a larger principle.

(5) it should not be a definition.

(6) it should not be confined to specific substances or varieties or with limited groups or substances. (WISE, 1941)

A concept is, primarily, an idea that results from drawing a generalization from particulars. Good teachers and curriculum developers will base their programs on principles, concepts and generalizations which have application in adult life and which can be developed with some form of meaning to

today's student. The prime instructional concern becomes one of justifying in the mind of the student the "need to know" and establishing a learning set which exhibits a positive motivation for the student.

Analysis

Once the concept or principle is identified, the next task is to subdivide it into an instructional form. This is done by the technique of educational analysis. There are several forms or types of analysis which are used. Briefly, the process can be outlined in the following manner;

1. Subject-matter analysis ... the identification of the major elements (principles/concepts) of a course.
2. Activity analysis ... the separation of skills and knowledge to determine the mode of instruction. (Demonstration vs. Reading, etc.)
3. Instructional analysis ... ordering the content for teaching purposes by blocking (process, machine, concept, etc.) or sequencing by logic (frequency of performance), psychological (simple to complex), and realistic (sequence of performance) order (Fryklund, 1965).

This manipulation results/in a two column listing of skills and knowledge sequenced for conversion to performance objectives in the psychomotor, cognitive and affective domains. The performance objectives are then written to include the condition(s) under which the task is to be done, the mode under which the task is to be accomplished and the level or extent of performance, either in qualitative or quantitative terms. Statements of this nature are called criterion referenced objectives and are essential to a computer managed instructional system. (Mager, 1962; Armstrong, et al., 1968).

Instructional Presentation

The delivery of a Learner-Controlled Education System is best accomplished by utilizing a computer management system for diagnostics and perscription and utilizing the learning activity package for directing student activities for achievement. This individualization can be unique for every student in the program.

Individualizing classroom activities has several advantages. First of all, any individualized material can be used as traditional classroom material if the students and teachers are unable to operate in the individualized environment. It is more difficult to use traditionally prepared materials in an individualized setting. Secondly, the teacher is forced to look at the learning activity from a number of different students' points of view. This has the effect of eliminating tunnel vision from the teacher's viewpoint on how different students might achieve the same objective from a number of approaches. Experience has indicated that teachers who prepare individualized learning materials are better teachers because of the experience, even if they don't use them as individualized materials in class.

The primary device for converting a traditional instruction program to an individualized Learner-Controlled Education System is the learning activity packet or "individualized study guide." It consists of the following sections and is written specifically as a study guide for the student.

--Primary objectives or goals -- these are broad goals or aims that will be achieved when the student completes the study--stated in general terms.

--Rationale -- this is a justification written for the student of why this task or goal will be offered it to them. It is the basis for motivation of the student and justifies the necessity for its accomplishment.

--Behavioral task -- this is a specific task generally itemized as a short term activity that gives a clear and concise picture of what the student is to accomplish. It states the conditions under which the job will be done, the task and mode of performance and the level or extent of competence. This task is sometimes referred to as a "criterion referenced objective."

--Student assessment -- this section requires the students to make a judgment about several things: (a) do you understand the objective? (b) do you have the necessary enabling skills to start this experience? (c) can you achieve all or part of the tasks stated without further learning on your part? This assessment is essential to help the student develop valid and reliable decision-making about his/her future educational experiences.

--Self-tests -- these tests are usually objective or performance exams to verify the judgments made in the student assessment (pre-test) or to evaluate the progress of students after a period of study on the objective (post-tests). They are student oriented and in no way are used to give grades. They are used strictly by the student to evaluate progress in the lesson.

--Student evaluation by the teacher -- this examination is administered by the teacher and may be an objective, essay, oral or performance evaluation. In some cases, it may be combined with other packets and administered as a "review" or midterm. In most cases, however, it is a very brief critique of student progress in the packet and may be called a "progress exam." Individualized lesson tests created and administered by the CMI portion of PHOENIX is a good example of this type of evaluation.

--Recommended media -- this lists a number of sources which the student might use to accomplish the lesson, objective or packet goals -- sometimes it is incorporated within the study guide. In either case, annotations regarding its usefulness (overview, specific pictorial description, well illustrated, simply explained, etc.) is provided. In some systems, they even provide levels of difficulty to help the student choose wisely. This section might also include a step-by-step procedure for lab activities with problems inserted for student response, or study guide options which will lead the student from a low level (knowledge) to a higher level (application) performance. In any case, it provides a wide variety of options at several difficulty levels from which the student chooses. This can also be included in the CMI portion of the program for each objective.

--Additional assignments -- realizing that the activity packet is dealing with a minimum competency level of achievement, additional indepth or extended experiences should be given for those who have the interest and ability to go beyond the stated objectives. This may sometimes be referred to as enrichment experience which is beyond the minimum stated goal or behavioral objectives of the packet.

--Packet evaluation -- this check point is designed to show acceptable comple tion of the packet and the objectives to which it is attached. At this time, the student and the teacher agree on satisfactory completion of the goals of the packet and continue to a new lesson or they agree on some recycling activities which are required to upgrade a task which is not sufficiently mastered to this point in time. This is one step on a

stairway of learning in the course. Packet length should be such that degrees of success should be obtainable over a reasonable period of time (6 - 10 hrs.).

To employ a LCE system, the classroom environment may change from a formal "chairs in a row or circle arrangement" to a diverse "resource center" arrangement. The individualization of education places the responsibility for motivation, material preparation and suggested sequencing on the teacher where is belongs.

Summary

I've tried, briefly, to give you some insights into learner-controlled education and the need to individualize learning. The necessity for a thorough understanding of learning theory and how it directly ties into classroom operation and material preparation is paramont. Listed below is a step-by-step general procedure which might be helpful in developing or revising instructional materials for individualized learning.

(1) Write down your philosophy of education and incorporate which theor(ies) of learning you're willing to live with in your classroom--"where are you coming from?" What beliefs do you hold on how students learn?

(2) Determine the areas or instruction units for which the packets or "study guides" will be prepared. Consider time for instruction and learning to be somewhere in the neighborhood of 5-10 hours long, so a degree of success and achievement can be within view from the student's end. (Grade levels and age will alter this.)

(3) Specify concepts or principles which you hope to teach. Subdivide these into sub-elements if necessary.

(4) Analyze the tasks on the basis of entrance skills and knowledges. What previous information is required to enable students to initiate learning at the level you have specified in your exit skills.

(5) Specify the knowledge requirements to perform stated exit skills or tasks, incorporating values and attitudes you wish students to exhibit upon completion of the learning experience.

(6) Order all the tasks into instructional units using "frequency of occurrence" and difficulty for sequence development. (Often used to seldom used and simple to complex activities.) Utilize "realistic" or performance order if it is appropriate.

(7) Identify the levels of performance associated with each of the tasks specified. (One taxonomy suggests 6 levels, high-medium-low is another simplified form.)

(8) Write behavioral objectives, being sure to include task, conditions of performance, mode of evaluation and extent or level of performance (must be in measurable qualitative or quantitative criteria).

(9) Develop the instructional activities or packages according to some acceptable system or acceptable format. Select the computer delivery system to achieve both CMI and CAI elements.

(10) Validate instructional packet (use other instructors, class critiques, etc.).

(11) Revise and try out on experimental group.

(12) Compare student performance with stated objectives to determine efficiency and the effectiveness of instruction. Does the system allow the student to achieve the stated objectives in the most efficient manner.

Individualizing instruction is a long purposeful process. Start small, do a bit at a time and in time with an LCE system students will learn the skills of effective learning as well as information which is of value. Accepting the system creates an accountable educational experience for both teacher and student.

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Learner Controlled Education System

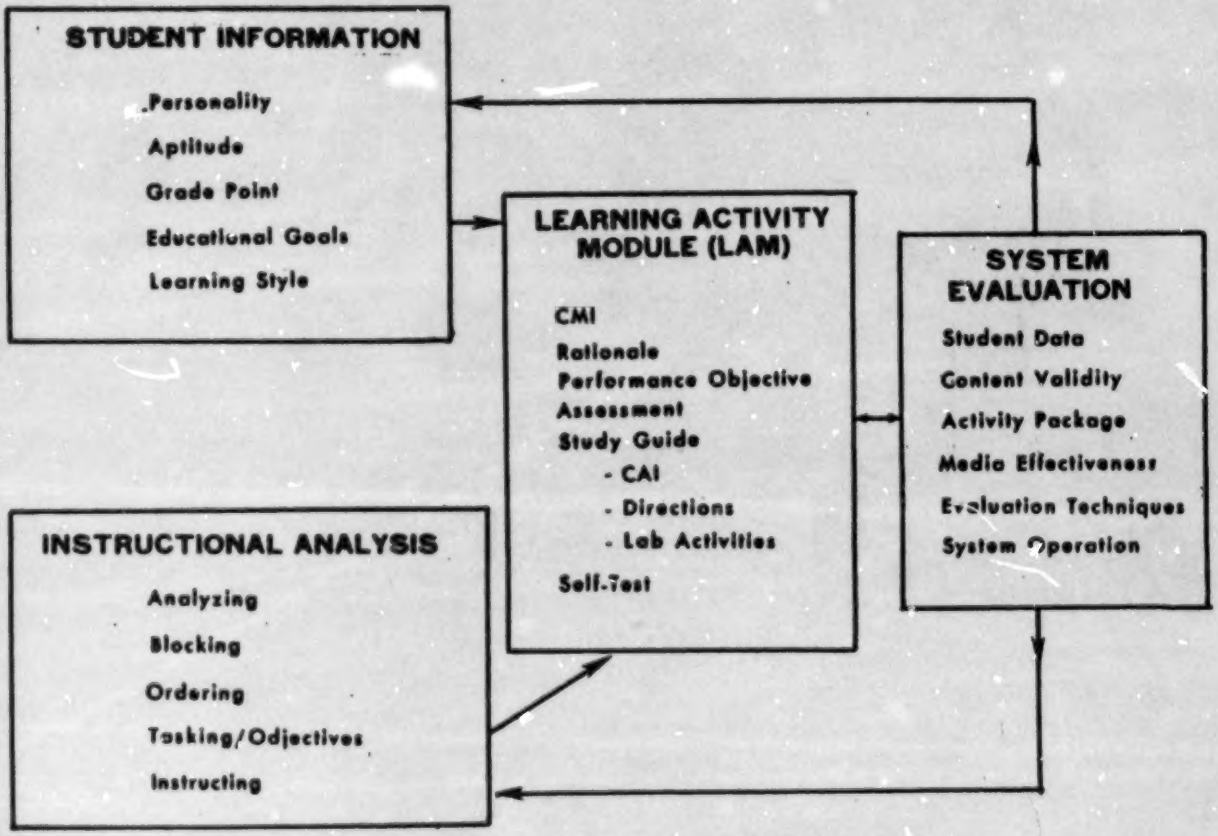

FIGURE 1